Recent Advances in Science in Western Australia

Life Sciences

The importance of trees as nesting and foraging sites for small, native mammals has been documented by C R Dickman of the University of Sydney. Observations in forests of eastern and western Australia indicate that at least half of all observed foraging occurs on tree surfaces or hollows, loose bark, logs or leaf litter. The requirements of several species are best met by large, mature trees and a complex ground layer that includes logs and leaf litter:

Dickman C R 1991 Use of trees by ground-dwelling mammals: implications for management. In, Conservation of Australia's Forest Fauna (Ed D Lunney) Royal Zoological Society of NSW, Mosman, 125-135.

Analysis by C R Dickman and colleagues of The University of Western Australia and the University of Sydney of the diets of sympatric barn owls *Tyto alba* and Australian kestrels *Falco cenchroides* show that house mice comprised the bulk of the diet of the barn owl, whereas reptiles and insects were the major prey categories in the diet of the kestrel. These dietary differences reflect the diurnal hunting activity of the Australian kestrel and nocturnal hunting, especially for house mice, by the barn owl:

Dickman C R, Daly S J, & Connell G W 1991 Dietary relationships of the barn owl and Australian kestrel on islands off the coast of Western Australia. Emu 91:69-72.

C R Dickman and colleagues, of The University of Western Australia and Sydney University, show that barn owls *Tyto alba* preferentially take small female house mice *Mus domesticus*. Adult mice appear to confine juvenile mice to more open vegetation, where resources are less and the risk of predation is higher:

Dickman C R, Predavec M, & Lynam A J 1991 Differential predation of size and sex classes of mice by the barn owl, *Tyto alba*. Oikos 62:67-76.

The resting metabolism of the desert burrowing frog *Neobatrachus pelobatoides* is shown by J E Flanigan and colleagues at The University of Western Australia to be reduced by 60-70% during aestivation. The metabolism of isolated skeletal muscle was reduced by 70% *in vitro*, indicating endogenous metabolic depression, but other tissues (intestine, liver, skin, fat) did not have an endogenous metabolic depression:

Flanigan J E, Withers P C, & Guppy M 1991 *In vitro* metabolic depression of tissues from the aestivating frog *Neobatrachus pelobatoides*. Journal of experimental Biology 161:273-283.

Whether south-west Australian Restionaceae plants survived fire (resprouter strategy) or were killed (obligate seeder strategy) was determined for 82 species by J S Pate and colleagues of The University of Western Australia, in a wide range of wetland, seasonally inundated and dryland habitats. Resprouters were shown to have larger rhizome diameters, lower culm:rhizome dry weight ratios, and more deeply buried perennating buds. Of the seven recognised categories of rhizome morphology, three were typical of seeders whereas the four were associated more with resprouters:

Pate J S, Meney K A, & Dixon K W 1991 Contrasting growth and morphological characteristics of fire-sensitive (obligate seeder) and fire-resistant (resprouter) species of Restionaceae (s. hemisphere restiads) from South-western Western Australia. Australian Journal of Botany 39:505-525.

The Tammar wallaby was formerly widespread throughout south-western Australia but is now much more restricted in distribution. W E Poole and colleagues from the CSIRO (Lyneham and Canberra) suggest from analyses of cranial morphometrics that there are three major regional groups (Western Australia; South Australian islands; New Zealand) which are apparently all related through a population from Eyre Peninsula that presumably represents the formerly widespread mainland population:

Poole W E, Wood J T, & Simms N G 1991 Distribution of the Tammar, *Macropus eugenii*, and the relationships of populations as determined by cranial morphometrics. Wildl. Res. 18:625-639.

Research by G F Craig, D T Bell and C A Atkins of The University of Western Australia on *Acacia* selected from areas of moderate to high soil salinity indicates that provenances from the most saline sites have greater potential to survive high levels of external salinity in the longer term than those from less saline sites. *A.* aff. *linecolata* and *A. mutabilis* subsp. *stipulifera* proved to be the most tolerant of the ten taxa tested in greenhouse stress tests:

Craig G F, Bell D T, & Atkins C A 1991 Response to salt and waterlogging stress of ten taxa of *Acacia* selected from naturally saline areas of Western Australia. Australian Journal of Botany 38:619-630.

G F Craig and colleagues of The University of Western Australia show, for two strains of *Rhizobium* from nodules of *Acacia redolens* growing in naturally saline areas of south-west Western Australia and two unselected strains from The University of Western Australia's collection, that tolerance of the legume host (*Acacia cyclops* and *A. redolens*) was the most important factor determining the success of compatible *Rhizobium* strains in forming effective symbioses under conditions of high soil salinity:

Craig G F, Atkins C A, & Bell D T 1991 Effect of salinity on growth of four strains of *Rhizobium* and their infectivity and effectiveness on two species of *Acacia*. Plant and Soil 133:253-262.

Analysis of the forage potential of 11 species of *Acacia* from naturally saline areas of Western Australia by G F Craig and colleagues of The University of Western Australia indicates that *Acacia amplicepS*, *A. brunalis*, *A. cyclops* and *A. ligustrina* are the most promising species for use as a perennial fodder shrubs. The ability of salt-tolerant acacias to grow in marginal land means they may provide supplementary forage in times of drought:

Craig G F, Bell D T, & Atkins C A 1991 Nutritional characteristics of selected species of *Acacia* growing in naturally saline areas of Western Australia. Australian Journal of Experimental Agriculture 31:341-345.

Of forty *Eucalyptus* and twenty *Melaleuca* species tested by P G van der Moezel and colleagues of The University of Western Australia, the tolerance of seedlings to salinity and waterlogging was highest for *E. occidentalis*, *E. sargentii*, *E. spathulata*, *E. intertexta*, *E. microtheca*, *E. raveretiana*, *E. striaticalyx* and *E. tereticornis*, and *M. laterifiora*, *M.* sp. aff. *lanceolata* and *M. thyoides*. Matching of suitable species with sites should allow reclamation of saline seeps and provide renewable resources of timber and fuelwood from habitats currently unavailable to agriculture or silviculture:

van der Moezel P G, Pearce-Pinto G V N, & Bell D T 1991 Screening for salt and waterlogging tolerance in *Eucalyptus* and *Melaleuca* species. Forest Ecology & Management 40:27-37.

Little work has been carried out on the systematics of Agaricales in Western Australia, but O K Miller describes eleven new species of *Amanita* mushroom from the southern *Eucalyptus*-dominated forests of Western Australia. All of the species were fruiting in native *Eucalyptus* forests ranging from 247 km north of Perth to Albany, 424 km south of Perth on the southern coast:

Miller O K 1991 New species of *Amanita* from Western Australia. Canadian Journal of Botany 69:2692-2703.

Why has the echidna has been less affected by extensive land clearing and exotic predators than many other mammals of the Western Australian wheatbelt? M Abenensperg-Traun of The University of Western Australia attributes the success of the echidna to its widespread habitat use, its specializing on termites and ants that are an abundant and reliable food source for which there is no apparent competition, its metabolic adjustment to drought and fire-induced food shortages, its independence of vegetation for shelter requirements, and minimal predation. Other myrmecophagous mammals in similar environments would experience similar benefits:

Abensperg-Traun M 1991 Survival strategies of the echidna *Tachyglossus aculeatus* Shaw 1792 (Monotremata: Tachyglossidae). Biological Conservation 58:317-328.

The effect of food distribution on the selection of foraging habitats, and the relationship between food availability, diet, ambient temperature, activity, use of shelter and energy budgets, were studied for the echidna in two Nature Reserves in the wheatbelt of Western Australia by researchers from The University of Western Australia. Food and shelter distribution, and ambient temperature, play important roles in influencing daily and seasonal foraging activity:

Abensperg-Traun M & De Boer E S 1992 The foraging ecology of a termite- and ant-eating specialist, the echidna *Tachyglossus aculeatus* (Monotremata: Tachyglossidae). Journal of Zoology 226:243-257.

Earth Sciences

A revision of a well-known fossil fauna by R A Henderson of the James Cook University, W J Kennedy of Oxford University, and K J McNamara of the WA Museum examines heteromorph ammonites from the Miria Formation (late Maastrichtian) and a nodule bed (early Maastrichtian) at the top of the underlying Korojon Calcarenite. *Eubaculites* occurs as three biostratigraphically discrete species while *Nostoceras* is restricted to the nodule bed:

Henderson R A, Kennedy, W J, & McNamara K J 1992 Maastrichtian heteromorph ammonites from the Carnarvon Basin, Western Australia. Alcheringa 16:133-170

In the first comprehensive review of miospores from the well-known Devonian reef complexes of the Lennard Shelf area, one hundred and forty two taxa recorded by K Grey of the Geological Survey of WA, indicate extremely diverse palynofloras, that are correlated with zones erected for the Old Red Sandstone Continent of northeastern Canada and northwestern Europe. The miospores indicated that sedimentation marking the beginning of reef development in some parts of Lennard Shelf had commenced by middle Givetian times:

Grey K 1992 Miospore assemblages from the Devonian reef complexes, Canning Basin, Western Australia. Geological Survey of Western Australia Bulletin 140.

A regional synthesis of active petroleum exploration by R M Hocking of the Geological Survey of Western Australia, shows two broad trends of lateral fining and upward fining. A number of laterally persistent and essentially synchronous event markers define the stages of deposition within the Jurassic succession:

Hocking R M 1992 Jurassic deposition in the southern and central North West Shelf, Western Australia. Geological Survey of Western Australia Record 1992/7.

A detailed study of an area of high petroleum prospectivity by K Wulff, of Phillips Australian Oil Company in Perth, subdivides Upper Jurassic syn-rift sediments in the eastern Barrow Sub-basin into five depositional sequences, each separated by regionally correlatable unconformities. Sequence boundary development can be closely related to periods of major changes in basin configuration associated with the sequential breakup of eastern Gondwana. Depositional models integrated with local seismic stratigraphy provide estimates of likely reservoir quality:

Wulff K 1992 Depositional history and facies analysis of the Upper Jurassic sediments in the eastern Barrow Sub-basin. The APEA Journal 32:104-122.

The Devonian to Lower Carboniferous succession is divided into at least 16 "Vail-type" sequences by a stratigraphic study of rocks associated with the outcropping reef complexes. M J Jackson and colleages of the BMR, Canberra, and Petroleum Securities, Sydney, describe two contrasting phases of development: a reef complex in the Frasnian-early Famennian, and a ramp in the late Famennian-Tournaisian. New and untested petroleum-exploration targets are identified in Famennian-Tournaisian highstand ramps and lowstand fans:

Jackson M J, Diekman L J, Kennard J M, Southgate P N, O'Brien P E, & Sexton M J 1992 Sequence stratigraphy, basin-floor fans and petroleum plays in the Devonian-Carboniferous of the northern Canning Basin. The APEA Journal 32:214-230.

Note from the Hon Editor: This column helps to link the various disciplines and inform others of the broad spectrum of achievements of WA scientists (or others writing about WA). Contributions to "Recent Advances in Science in Western Australia" are welcome, and may include papers that have caught your attention or that you believe may interest other scientists in Western Australia and abroad. They are usually papers in refereed journals, or books, chapters and reviews. Abstracts from conference proceedings will not be accepted. Please submit short (2-3 sentence) summaries of recent papers, together with a copy of the title, abstract and authors' names and addresses, to the Hon Editor or a member of the Publications Committee: Dr S D Hopper (Life Sciences), Dr A E Cockbain (Earth Sciences), and Assoc Prof J Webb (Physical Sciences). Final choice of articles is at the discretion of the Hon Editor.

"Letters to the Editor" concerning scientific issues of relevance to this journal are also published at the discretion of the Hon Editor. Please submit a word processing disk with letters and suggest potential reviewers or respondents to your letter. *P C Withers, Hon Editor, Journal of the Royal Society of WA.*